Claims:

1. A method for forming a tungsten nitride layer, comprising:

alternately pulsing a tungsten-containing compound and a nitrogen-containing compound until a tungsten nitride layer having a thickness of about 100 angstroms or less is formed.

2. The method of claim 1, further comprising continuously flowing argon.

3. The method of claim 1, wherein the pulsing occurs at a pressure of about 1.5 torr and a temperature of about 550°C or more.

4. The method of claim 1, wherein each pulse of the tungsten-containing compound has a duration between about 0.2 seconds and about 1 second.

5. The method of claim 1, wherein each pulse of the nitrogen-containing compound has a duration between about 0.2 seconds and about 1 second.

6. The method of claim 1, wherein each pulse of the tungsten-containing compound has a flowrate between about 1 sccm and about 400 sccm.

7. The method of claim 1, wherein each pulse of the nitrogen-containing compound has a flowrate between about 5 sccm and about 150 sccm.

8. The method of claim 1, wherein the tungsten-containing is selected from the group consisting of tungsten hexafluoride, tungsten hexacarbonyl ($W(CO)_6$), and a combination thereof.

9. The method of claim 1, wherein the tungsten-containing compound comprises tungsten hexafluoride.

10. The method of claim 1, wherein the nitrogen-containing compound is selected from the group consisting of nitrogen gas (NH_2), ammonia (NH_3), hydrazine (N_2H_4),

monomethyl hydrazine ($CH_3N_2H_3$), dimethyl hydrazine ($C_2H_6N_2H_2$), t-butyl hydrazine ($C_4H_9N_2H_3$), phenyl hydrazine ($C_6H_5N_2H_3$), 2,2'-azoisobutane ($(CH_3)_6C_2N_2$), ethylazide ($C_2H_5N_3$), and combinations thereof

11. The method of claim 1, wherein the nitrogen-containing compound comprises ammonia.

12. A method for forming a tungsten layer, comprising:

depositing a tungsten nitride barrier layer by alternately pulsing a first tungsten-containing compound and a nitrogen-containing compound; and

depositing a tungsten layer by alternately pulsing a second tungsten-containing compound and a reducing compound.

13. The method of claim 12, wherein the first tungsten-containing compound and the second tungsten-containing compound are each selected from the group consisting of tungsten hexafluoride, tungsten hexacarbonyl ($W(CO)_6$), and a combination thereof.

14. The method of claim 12, wherein the first tungsten-containing compound and the second tungsten-containing compound both comprise tungsten hexafluoride.

15. The method of claim 12, wherein the nitrogen-containing compound is selected from the group consisting of nitrogen gas (NH_2), ammonia (NH_3), hydrazine (N_2H_4), monomethyl hydrazine ($CH_3N_2H_3$), dimethyl hydrazine ($C_2H_6N_2H_2$), t-butyl hydrazine ($C_4H_9N_2H_3$), phenyl hydrazine ($C_6H_5N_2H_3$), 2,2'-azoisobutane ($(CH_3)_6C_2N_2$), ethylazide ($C_2H_5N_3$), and combinations thereof.

16. The method of claim 12, wherein the nitrogen-containing compound comprises ammonia.

17. The method of claim 12, wherein the reducing compound is selected from the group consisting of silane (SiH_4), disilane (Si_2H_6), dichlorosilane ($SiCl_2H_2$), borane (BH_3), diborane (B_2H_6), triborane (B_3H_9), tetraborane (B_4H_{12}), pentaborane (B_5H_{15}),

hexaborane (B_6H_{18}), heptaborane (B_7H_{21}), octaborane (B_8H_{24}), nanoborane (B_9H_{27}) and decaborane ($B_{10}H_{30}$), and combinations thereof.

18. The method of claim 12, wherein the reducing compound comprises silane.

19. The method of claim 12, further comprising continuously flowing argon.

20. The method of claim 12, wherein the pulsing occurs at a pressure of about 1.5 torr and a temperature of about 550°C or more.

21. The method of claim 12, wherein each pulse of the first and second tungsten-containing compound has a duration between about 0.2 seconds and about 1 second.

22. The method of claim 12, wherein each pulse of the nitrogen-containing compound has a duration between about 0.2 seconds and about 1 second.

23. The method of claim 12, wherein each pulse of the reducing compound has a duration between about 0.2 seconds and about 1 second.

24. The method of claim 12, wherein each pulse of the first and second tungsten-containing compound has a flowrate between about 1 sccm and about 400 sccm.

25. The method of claim 12, wherein each pulse of the nitrogen-containing compound has a flowrate between about 5 sccm and about 150 sccm.

26. The method of claim 12, wherein each pulse of the reducing compound has a flowrate between about 5 sccm and about 150 sccm.

27. The method of claim 12, wherein the tungsten nitride barrier layer has a thickness of about 20 angstroms.

28. The method of claim 12, wherein the tungsten layer has a thickness greater than 300 angstroms.

29. The method of claim 12, further comprising pulsing argon between the alternate pulses of the first tungsten-containing compound and the nitrogen-containing compound.

30. The method of claim 12, further comprising pulsing argon between the alternate pulses of the second tungsten-containing compound and the reducing compound.

31. A method for forming a tungsten layer, comprising:

depositing a tungsten nitride barrier layer by alternately pulsing a first tungsten-containing compound and a nitrogen-containing compound; and

depositing a tungsten layer on the barrier layer.

32. The method of claim 31, wherein the tungsten layer is deposited by chemical vapor deposition or physical vapor deposition techniques.

33. The method of claim 31, wherein the tungsten layer is deposited by alternately pulsing a second tungsten-containing compound and a reducing compound.

34. The method of claim 33, wherein the tungsten layer is deposited by alternately pulsing the second tungsten-containing compound and the reducing compound to form a pre-layer having a thickness of about 50 angstroms or less followed by bulk tungsten deposition using chemical vapor deposition or physical vapor deposition.

35. The method of claim 31, wherein the first tungsten-containing compound is selected from the group consisting of tungsten hexafluoride, tungsten hexacarbonyl ($W(CO)_6$), and a combination thereof.

36. The method of claim 33, wherein the second tungsten-containing compound is selected from the group consisting of tungsten hexafluoride, tungsten hexacarbonyl ($W(CO)_6$), and a combination thereof.

37. The method of claim 33, wherein the first tungsten-containing compound and the second tungsten-containing compound both comprise tungsten hexafluoride.

38. The method of claim 31, wherein the nitrogen-containing compound is selected from the group consisting of nitrogen gas (NH_2), ammonia (NH_3), hydrazine (N_2H_4), monomethyl hydrazine ($CH_3N_2H_3$), dimethyl hydrazine ($C_2H_6N_2H_2$), t-butyl hydrazine ($C_4H_9N_2H_3$), phenyl hydrazine ($C_6H_5N_2H_3$), 2,2'-azoisobutane ($(CH_3)_6C_2N_2$), ethylazide ($C_2H_5N_3$), and combinations thereof.

39. The method of claim 33, wherein the reducing compound is selected from the group consisting of silane (SiH_4), disilane (Si_2H_6), dichlorosilane ($SiCl_2H_2$), borane (BH_3), diborane (B_2H_6), triborane (B_3H_9), tetraborane (B_4H_{12}), pentaborane (B_5H_{15}), hexaborane (B_6H_{18}), heptaborane (B_7H_{21}), octaborane (B_8H_{24}), nanoborane (B_9H_{27}) and decaborane ($B_{10}H_{30}$), and combinations thereof.

40. The method of claim 33, wherein the reducing compound comprises silane.

41. The method of claim 31, further comprising continuously flowing argon.

42. The method of claim 31, wherein the pulsing occurs at a pressure of about 1.5 torr and a temperature of about 550°C or more.

43. The method of claim 31, wherein the tungsten nitride barrier layer has a thickness less than 20 angstroms and the tungsten layer has a thickness greater than 300 angstroms.

44. A method for forming a metal gate electrode, comprising:

heating a wafer having a polysilicon layer disposed thereon to a temperature of about 550°C or more;

forming a chlorine terminated surface by exposing the polysilicon layer to a chlorine-containing compound;

depositing a tungsten nitride barrier layer over the polysilicon layer, wherein the tungsten nitride barrier layer is formed by alternately pulsing a first tungsten-containing compound and a nitrogen-containing compound until a tungsten nitride layer having a thickness less than about 50 angstroms is deposited; and

depositing a tungsten layer on the tungsten nitride barrier layer.

45. The method of claim 44, wherein the chlorine-containing compound comprises dichlorosilane.

46. The method of claim 44, wherein the nitrogen-containing compound is pulsed first and the first tungsten-containing compound is pulsed second.

47. The method of claim 44, wherein the tungsten layer is deposited by alternately pulsing a second tungsten-containing compound and a reducing compound.

48. The method of claim 44, wherein the tungsten layer is deposited by chemical vapor deposition or physical vapor deposition.

49. The method of claim 47, wherein the tungsten layer is deposited by alternately pulsing the second tungsten-containing compound and the reducing compound to form a pre-layer having a thickness of about 50 angstroms or less followed by chemical vapor deposition or physical vapor deposition to complete the tungsten layer.

50. The method of claim 44, wherein the tungsten layer has a thickness greater than 300 angstroms.

51. The method of claim 44, wherein the first tungsten-containing compound is selected from the group consisting of tungsten hexafluoride, tungsten hexacarbonyl ($W(CO)_6$), and a combination thereof.

52. The method of claim 47, wherein the second tungsten-containing compound is selected from the group consisting of tungsten hexafluoride, tungsten hexacarbonyl ($W(CO)_6$), and a combination thereof.

53. The method of claim 44, wherein the nitrogen-containing compound is selected from the group consisting of nitrogen gas (NH_2), ammonia (NH_3), hydrazine (N_2H_4), monomethyl hydrazine ($CH_3N_2H_3$), dimethyl hydrazine ($C_2H_6N_2H_2$), t-butyl hydrazine ($C_4H_9N_2H_3$), phenyl hydrazine ($C_6H_5N_2H_3$), 2,2'-azoisobutane ($(CH_3)_6C_2N_2$), ethylazide ($C_2H_5N_3$), and combinations thereof.

54. The method of claim 47, wherein the reducing compound is selected from the group consisting of silane (SiH_4), disilane (Si_2H_6), dichlorosilane ($SiCl_2H_2$), borane (BH_3), diborane (B_2H_6), triborane (B_3H_9), tetraborane (B_4H_{12}), pentaborane (B_5H_{15}), hexaborane (B_6H_{18}), heptaborane (B_7H_{21}), octaborane (B_8H_{24}), nanoborane (B_9H_{27}) and decaborane ($B_{10}H_{30}$), and combinations thereof.

55. The method of claim 47, wherein the reducing compound comprises silane.

56. The method of claim 44, further comprising continuously flowing argon.

57. The method of claim 44, wherein the pulsing occurs at a pressure of about 1.5 torr.

58. A method for forming a metal gate electrode on a wafer, comprising:

heating a wafer having a polysilicon layer disposed thereon to a temperature of about 550°C or more;

forming a chlorine terminated surface by exposing the polysilicon layer to a chlorine-containing compound;

reducing the chlorine terminated surface by exposing the polysilicon layer to a nitrogen-containing compound; and then

depositing a tungsten layer over the polysilicon layer, wherein the tungsten layer is formed by alternately pulsing a tungsten-containing compound and a reducing compound.

59. The method of claim 58, further comprising depositing a tungsten nitride barrier layer over the polysilicon layer prior to depositing the tungsten layer, wherein the tungsten nitride barrier layer is formed by alternately pulsing tungsten hexafluoride and ammonia until a tungsten nitride layer having a thickness less than 50 angstroms is deposited.

60. The method of claim 58, wherein the chlorine-containing compound comprises dichlorosilane.

61. The method of claim 58, wherein the reducing compound is selected from the group consisting of silane (SiH_4), disilane (Si_2H_6), dichlorosilane ($SiCl_2H_2$), borane (BH_3), diborane (B_2H_6), triborane (B_3H_9), tetraborane (B_4H_{12}), pentaborane (B_5H_{15}), hexaborane (B_6H_{18}), heptaborane (B_7H_{21}), octaborane (B_8H_{24}), nanoborane (B_9H_{27}) and decaborane ($B_{10}H_{30}$), and combinations thereof.

62. The method of claim 58, wherein the tungsten-containing compound is selected from the group consisting of tungsten hexafluoride, tungsten hexacarbonyl ($W(CO)_6$), and a combination thereof.

63. The method of claim 58, wherein the nitrogen-containing compound is selected from the group consisting of nitrogen gas (NH_2), ammonia (NH_3), hydrazine (N_2H_4), monomethyl hydrazine ($CH_3N_2H_3$), dimethyl hydrazine ($C_2H_6N_2H_2$), t-butyl hydrazine ($C_4H_9N_2H_3$), phenyl hydrazine ($C_6H_5N_2H_3$), 2,2'-azoisobutane ($(CH_3)_6C_2N_2$), ethylazide ($C_2H_5N_3$), and combinations thereof.

64. The method of claim 58, wherein the tungsten layer has a thickness greater than 300 angstroms.